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PN - JP11275106 A 19991008  
TI - COMMUNICATIONS SYSTEM  
AB - **PROBLEM TO BE SOLVED:** To improve efficiency of network management by dividing communication equipment into plural groups and performing network management by a group unit. **SOLUTION:** This system is composed of an application interface part 1 for receiving transmission/reception requests from an application, a mode storage part 2 for storing which one of a server mode, a client mode and an initial mode its own operation mode is, a communication management part 6 for performing the processing of group constitution composed of the plural communication equipments corresponding to the operation mode stored in the mode storage part, a communication group information storage part 3 for storing the identifier of the member of the group, a present equipment identification information storage part 4 for storing its own identifier, another equipment information storage part 5 for storing the identifier of another equipment recognized as communicable by itself, a transmission part 8 for transmitting data to a network, a reception part 9 for receiving the data from the network and a timer part 7 used in the processing of the group constitution by the communication management part.

FI - G06F13/00&355; H04L11/00&310B; H04L12/28&300M  
PA - TOKYO SHIBAURA ELECTRIC CO  
IN - IKEGAMI FUMIHIKO; IWAMURA KAZUAKI  
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**CLAIMS**


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**[Claim(s)]**

[Claim 1] In the communication system with which it consists of two or more communication devices, and at least one employs a server and others as a client The server mode in which it operates as a server which judges the propriety of adding the communication device in which self-\*\* and a communication link are possible to the communication link group to whom self belongs, Communication system characterized by a communication device having at least two modes in the client mode in which it operates as a client which joins the communication link group to whom the server which obtained authorization of communication link group subscription from other communication devices which operate as a server, and obtained authorization belongs.

[Claim 2] Communication system according to claim 1 characterized by into any to make the mode in which negotiate with self and the communication device which can be communicated by communication link, and self operates, between server mode and client mode, and the thing for which it opts.

[Claim 3] Communication system according to claim 1 characterized by choosing probable into any the mode in which self operates shall be made between server mode and client mode.

[Claim 4] If the packet of two or more communication devices which indicated the identifier of a random number or an equipment proper is transmitted, respectively and said packet is received By distinguishing each transmitting person of said packet by the random number or identifier of a publication to said packet Communication system according to claim 3 which measures the number of the communication devices which transmitted the packet, and is characterized by choosing the mode in which compute the probability for self to serve as a server from the number of the measured communication devices on a formula or a table, and it operates based on said probability.

[Claim 5] Communication system according to claim 1 characterized by setting up the mode of each communication device when the mode setting equipment which elected one as mode setting equipment and was elected from two or more communication devices is determined in \*\*\*\*\* of operation by any in server mode or client mode about said each of two or more communication devices and notifies to said each of two or more communication devices.

[Claim 6] The communication device denied the subscription in a communication link group from all the servers that can communicate is communication system according to claim 1 which generates a communication link group and is newly characterized by making it become a communication link group's generated server.

[Claim 7] It is the communication system according to claim 1 which a communication link group's server transmits the packet which shows existence of self periodically to the client belonging to said communication link group, and whether said packet is received periodically supervises a client, and is characterized by judging that the communication link of a server became impossible, and electing an alternative server from said clients if received no longer.

[Claim 8] It is the communication system according to claim 1 characterized by judging whether a server adds said equipment to the communication link group to whom self belongs by comparing the information about a self user with received User Information by the communication device which wishes to join a communication link group making information about the user of the equipment User Information, and transmitting to said communication link group's server.

[Claim 9] When two or more communication devices which operate in server mode negotiate

mutually, the communication link group identification descriptor of a meaning is set up among communication link groups. The device identification child of a meaning is given to each communication device with which each communication device which operates in server mode belongs to the same communication link group as self-\*\* within a communication link group. The communication device belonging to each communication link group Communication system according to claim 1 characterized by obtaining the address which belongs to other communication link groups by combining the communication link group identification descriptor of the communication link group to whom self-\*\* belongs, and the device identification child given from the server of the communication link group to whom self belongs, and in which a communication device and a communication link are possible.

[Claim 10] When the communication device belonging to the same communication link group negotiates mutually, the device identification child of a meaning is set up within a communication link group. The communication device which sets up the communication link group identification descriptor of a meaning among communication link groups, and belongs to each communication link group when said communication link group's server negotiates with other communication link groups' server Communication system according to claim 1 characterized by obtaining the address which belongs to other communication link groups by combining the communication link group identification descriptor of the communication link group to whom self belongs, and the device identification child of self, and in which a communication device and a communication link are possible.

[Claim 11] Communication system according to claim 1 characterized by preparing the group of a high order further, choosing from said two or more communication link groups whether each server of two or more of said communication link groups operates in which the mode of the server in the group of said high order, or a client when two or more communication link groups exist, and performing said selected actuation in the group of a high order, and actuation as a server in said two or more communication link groups.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]**

**[0001]**

**[Field of the Invention]** This invention sets up a connection among two or more communication devices, it is the communication system which communicates and at least one of two or more of the communication devices is related with a server and the communication system which employs others as a client.

**[0002]**

**[Description of the Prior Art]** The technique which constitutes a network in ad hoc using two or more communication devices is proposed by Japanese Patent Application No. No. 87937 [ 07 to ]. A network consists of autonomously networks constituted based on this technique by which patent application was carried out by recognizing the condition of a communication link mutual [ between the communication devices with which each equipment broadcasts periodically the packet which indicated the information about self, and the information about other communication devices recognized / that self can communicate and / as a beacon, receives said beacon, and exists in a perimeter ], without being based on setting out of a user.

**[0003]** Moreover, using information given in the beacon received periodically, dissipation of the communication device by the appearance of the new communication device by powering on etc., cutting of the communication link by the obstruction, powering off, etc. is detected at any time, and a network is reconfigured.

**[0004]** In transmission and reception of data, a group is constituted from two or more communication devices which can communicate mutually based on the information about said recognized communication link, and data transmission with the sufficient effectiveness between two or more equipments is made possible by multicasting data to the group's member.

**[0005]**

**[Problem(s) to be Solved by the Invention]** With the technique of said explanation, it increases as the number of the amount of the information which the number of the beacons broadcast increases in proportion to the number of communication devices, and is indicated by the beacon of the communication devices which exist in a perimeter increases.

**[0006]** Therefore, when the number of communication devices increases, the problem that a beacon presses a network band arises.

**[0007]** Moreover, since the throughput for network management will increase if the number of equipment increases and beacons increase in number in order that each equipment may manage a network by distributed processing using the information on a publication on the received beacon, the problem of causing lowering of transmission speed is also produced.

**[0008]** These problems had become a failure at the time of constituting the network which consists of more communication devices.

**[0009]** Then, the place made into the object of this invention elects a server from two or more communication devices. When the elected server generates a communication link group and adds to a communication link group by making said two or more of other equipments into a client, it enables it to constitute a communication link group. Autonomous network administration by transmission and reception of the beacon shown in the technique of Japanese Patent Application No. No. 87937 [ 07 to ] can be performed per said communication link group, and it is in offering the

communication system which enabled it to cope with the increment in the number of equipment flexibly.

[0010]

[Means for Solving the Problem] In order to attain the above-mentioned object, it sets to this invention. In the communication system with which it consists of two or more communication devices, and at least one employs a server and others as a client By newly preparing a communication link group, making a communication device belong to either of two or more communication link groups, and processing recognition of the communication device of the perimeter by transmission and reception of a beacon, network management, etc. in said communication link group's unit Band pressure of the network by the increment in a communication device and the increment in the throughput of a communication device are prevented.

[0011] A communication link group's configuration elects the communication device which serves as a communication link group's server first, and it is made to perform it when a server adds to the communication link group of self by making other equipments into a client.

[0012] In the communication system with which this invention consists of two or more communication devices, and at least one employs a server and others as a client Since it enabled it to constitute a communication link group when a server was elected from two or more communication devices, and the elected server generated a communication link group and added to a communication link group by making said two or more of other equipments into a client Autonomous network administration by transmission and reception of the beacon shown in Japanese Patent Application No. No. 87937 [ 07 to ] can be performed now per said communication link group, and the communication system which can cope with the increment in the number of equipment flexibly is obtained.

[0013]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained with reference to a drawing.

[0014] (1st operation gestalt) Drawing 1 is the example of a configuration of the communication device in this invention. With reference to drawing, the function of this structure of a system and each part is explained. As shown in drawing 1 , this system consists of the application interface section 1, the mode storage section 2, the communication link group information storage section 3, the self-device identification information storage section 4, the other equipment information storage section 5, the communication management section 6, the timer section 7, the transmitting section 8, and a receive section 9.

[0015] Among these, the application interface section 1 has a network WAKUHE delivery \*\*\*\* function for the data through the transmitting section 8, when directions of transmission of data are received from Application AP. However, transmission is refused when the communication management section 6 judges that transmission and reception of data are not ready. Moreover, what was judged to be data addressed to self-equipment which the application of other equipments transmitted by the data received by the receive section 9 is passed to the application of self-equipment.

[0016] The mode storage section 2 memorizes the mode of operation of equipment. A mode of operation here is three kinds, "server mode", "client mode", and a "initialization mode."

[0017] The communication link group information storage section 3 memorizes "a communication link group's identifier to which self-equipment belongs", "the list of identifiers of the communication link group's client", and "the identifier of the communication link group's server."

[0018] The self-device identification information storage section 4 stores the information used as an identifier of self-equipment. As an identifier of self-equipment, the random number generated each time is used at the number of the value which the user set up, and the equipment proper given at the time of manufacture, a power up, the time of communication link initiation, etc.

[0019] The other equipment information storage section 5 memorizes a "device identification child" and "a communication link group's identifier which the server manages" about "the equipment recognized to be a server" by receiving the "server packet" which the equipment which is operating as a server of a "communication link group" transmits.

[0020] By performing a communication link with other equipments through the transmitting section

8 and a receive section 9, the communication management section 6 sets up the information on the address required in order that the application of self-equipment and the application of other equipments may communicate mutually through the application interface section 1 etc., and has the function memorized in each above-mentioned storage sections 2-5.

[0021] The timer section 7 will be notified to the communication management section 6, if it is set by the communication management section 6 and the specified time amount passes. If the data which should be transmitted from the application interface section 1 and the communication management section 6 are received, the transmitting section 8 adds a header to the data, and sends it out to a network as a packet.

[0022] The classification of a packet is as follows.

[0023] \*\*[1] application data packet - [2] Server packet - [3] Subscription application packet - [4] Subscription authorization packet - [5] a subscription refusal packet -- the packet of these is explained below.

A [application data packet] application data packet is a packet which indicated the data which Application AP transmits. Directions of transmission are taken out to the transmitting section 8 by the application interface section 1, and if a receive section 9 receives, the application interface section 1 will be passed. The other packet will be passed to the communication management section 6, if the communication management section 6 generates, transmission is directed in the transmitting section and a receive section 9 receives.

[0024] [A server packet "a server packet"] transmits, in order that the equipment which operates as a communication link group's server may show that self is a server to other equipments, and said communication link group's identifier is indicated.

[0025] A [subscription application packet] subscription application packet is a packet sent towards a communication link group's server, and shows that the transmitting person of the packet wishes subscription in the communication link group.

[0026] A [subscription authorization packet and subscription refusal packet] subscription authorization packet and a subscription refusal packet are packets sent from a server as a response to the transmitting person of a subscription application packet, and show the propriety of subscription in a communication link group. If a packet is received from a network, by investigating the destination of a publication to a header, a receive section 9 judges whether the packet is addressing to self-equipment, and if it is not addressing to self-equipment, or a "broadcasting packet", it will discard. In being addressing to self-equipment, or a "broadcasting packet", it passes and the packet classification of a publication is seen to DDA, and if the packet is an "application data packet", if it is the other packet, it will pass data to the application interface section 1 at the communication management section 6, respectively.

[0027] <Actuation to communication link initiation>, next actuation until it starts a communication link are explained.

[0028] A flow chart is shown in drawing 2 - drawing 4. General drawing, drawing 3, and drawing 4 of drawing 2 are the elements on larger scale. Actuation is explained using drawing. The mode of operation of the communication device which is newly going to communicate is set to either "server mode" or a "initialization mode." The communication management section 6 of the communication device concerned which is newly going to communicate reads a mode of operation from the mode storage section 2. And the read mode of operation is investigated (S1, S2). Consequently, if the read mode of operation is a server, the communication management section 6 will newly generate the communication link group whom self manages (S3). When generated, a communication link group's member is only one set of a server.

[0029] A server is adding to a sequential communication link group by making into a client the equipment of other initialization modes which wish subscription in a communication link group, and increases a member. The equipment which joined the communication link group changes a mode of operation into "client mode" from a "initialization mode."

[0030] A server determines a communication link group's generated identifier with a "random number" etc., and memorizes it in the communication link group information storage section 3. Let "random numbers" be enough many digit counts so that it may not collide with the random number which other servers generate.

[0031] A server broadcasts periodically the "server packet" which indicated a "self-device identification child" and the above "a communication link group's identifier", in order to tell other equipments about self being the communication link group's server, if "a communication link group's identifier" is generated (S4).

[0032] In SSUTEPPU S1, if the read mode of operation is a "initialization mode", the communication management section 6 of the communication device will await reception of the "server packet" which a server transmits (S9). And reception of a "server packet" sends the "subscription application packet" for applying for subscription in a communication link group to the server which transmitted the packet (S10).

[0033] When a "server packet" is received from two or more servers, from the inside, one is chosen and a "subscription application packet" is sent to the selected server.

[0034] With the equipment whose mode of operation is a server, the communication management section's 6 reception of a "subscription application packet" judges the propriety of subscription in the communication link group whom self manages with reference to the communication link group information storage section 3 (S5, S6).

[0035] It is that the sum total of the equipment which has joined the communication link group, for example does not exceed the fixed numbers defined beforehand as criteria of decision etc.

[0036] If it judges that subscription is allowed, the communication-management section 6 transmits the "subscription authorization packet" which indicated the identifier of the communication link group who permits subscription to the equipment which transmitted the "subscription application packet" (S8), and the identifier of above equipment will newly add to "a list of device-identification children of a communication link group's client" which self-\*\* memorized by the communication link group information storage section 3 manages.

[0037] Moreover, when it is judged that subscription is not allowed, a "subscription refusal packet" is transmitted (S7).

[0038] With the equipment whose mode of operation is a "initialization mode", if a "subscription authorization packet" is sent from a server, "a communication link group's identifier", and "the device-identification child of a server" to whom subscription was permitted by the communication link group information storage section 3 based on the "subscription authorization packet" concerned will be indicated, and the mode of operation of the self-equipment memorized by the mode storage section 2 will be rewritten in "client mode" from a "initialization mode" (S11, S12, S13). And it becomes a client (S14).

[0039] The equipment used as "client mode" is disregarded even if it receives a "server packet." Moreover, when the "subscription refusal packet" has been sent, reception of the "server packet" sent from servers other than the server which refused subscription is awaited.

[0040] When it is judged that the equipment which is a server can add a new client to the communication link group whom self manages, a client is invited by broadcasting a "server packet" periodically. Moreover, when it is judged that more than this and a client cannot be added to the communication link group whom self manages, transmission of a "server packet" is suspended.

[0041] If a new client can be added now to a communication link group by withdrawal from the communication link group of a client etc., periodical transmission of a "server packet" will be resumed.

[0042] A communication link group is generable for every server because a client joins the communication link group generated by this as one set or two or more servers be alike, respectively one by one. Each of a communication link group is mutually distinguished by the "communication link group identification descriptor" which the server gave. By using a different communication channel for every communication link group, interference by other communication link groups' communication link can be prevented, and communicative effectiveness improves.

[0043] Drawing 5 is drawing explaining actuation of each communication device in this operation gestalt. "The equipment 1" and "the equipment 4" which were set as server mode, and "the equipment 2", "equipment 3", "equipment 2", "equipment 3", "the equipment 5" and "the equipment 6" which were set as the "initialization mode" It gets to know that servers are "equipment 1" and "equipment 4" by receiving the "server packet" which "equipment 1" and "equipment 4" take out, and, as for "equipment 5" and "equipment 6", "equipment 2", and "equipment 3" send a

"subscription application packet" to "equipment 4" as opposed to "equipment 1", respectively.

[0044] "Equipment 2", "equipment 3", "equipment 5", and "equipment 6" will change a mode of operation into a "client", if subscription is permitted.

[0045] Thus, the "communication link group 2" who consists of the "communication link group 1" and "equipment 4", "the equipment 5", and "the equipment 6" which consist of "equipment 1", "equipment 2", and "equipment 3" is generated.

[0046] It is collected from said client, using information, such as a "device identification child" about the client belonging to the communication link group of self, and "a user name of equipment", as "equipment information", and a server tells other servers about it.

[0047] the "equipment information" to which self holds a server -- and -- "-- others -- equipment information" obtained from the server is sent to the client of the communication link group of self according to a demand.

[0048] Thereby, all the equipments that exist in a network can acquire the information about all the equipments of the others also containing the equipment belonging to the communication link group to whom self does not belong, and can choose the equipment made into a communications partner based on this.

[0049] The equipments belonging to a different communication link group do not perform direct communication. When communicating, the communication link by junction is performed through the server of the communication link group to whom each equipment belongs.

[0050] Broadcasting of a "server packet" is not performed but a "server explorer packet" for the equipment of an initialization mode to look for a server is broadcast, and only when this packet is received, a server addresses a "server packet" only to above equipment, and you may make it transmit, although he is trying for a server to invite a client by the above-mentioned method by broadcasting periodically the "server packet" which shows that self is a server.

[0051] Thus, if a "server packet" is transmitted by the unicast only when there is a demand from equipment which wants to join a communication link group, the communication link of equipments which does not need a "server packet" will not be blocked, and communicative effectiveness will improve.

[0052] moreover, not only in "a communication link group's identifier" which the server manages as amelioration of the above-mentioned method to the "server packet" which a server transmits By seeing "the communication link group's number of clients" indicated by the "server packet" which indicated and transmitted "the number of the clients which have joined the communication link group", and other servers received It can control now so that a client does not concentrate only on a specific communication link group.

[0053] For example, when there are more clients of a communication link group which self-\*\* manages than other communication link groups' number of clients, suppose that it stops newly adding a client etc.

[0054] (2nd operation gestalt) In the 1st operation gestalt, the mode of operation of equipment is set up beforehand, and although the equipment used as a server was decided, if the equipment which serves as a server from two or more equipments into which the power source was put simultaneously is elected automatically, the time and effort of setting out of the mode of operation by the user can be abolished. This method is explained below as 2nd operation gestalt.

[0055] First, a different point from the 1st operation gestalt is described. By this method, all the equipments that are newly going to communicate start actuation as a "initialization mode." In the other equipment information storage section 5, the "identifier" of all the equipments with which not only the equipment that is a server but self-equipment has recognized existence is memorized, and, in addition to a "device identification child", it memorizes in it any of "server mode", "client mode", and a "initialization mode" the modes of operation of the equipment are.

[0056] Moreover, in addition to the "server packet" explained in the 1st operation gestalt, with this operation gestalt, the "self-device identification child packet" which indicated the identifier of self-equipment is newly used. This "self-device identification child packet" transmits, in order that the equipment which operates by "client mode" or a "initialization mode" may tell other equipments about existence of self.

[0057] In a "self-device identification child packet", "a transmitting person's device identification



child" and a "mode of operation" are indicated.

[0058] <Actuation until it sets up a communication link group>, next actuation until it sets up a communication link group are explained. A flow chart is shown in drawing 6 - drawing 8. Drawing 6 is general drawing and drawing 7 and drawing 8 are the elements on larger scale. In the communication device which is newly going to communicate by the charge of a power source etc. The communication management section 6 sets a mode of operation as a "initialization mode" (S21). After requiring that it should be told that the time amount (it considers as an initial processing period) defined beforehand passes to the timer section 7 (S22), The "device identification child packet" which indicated the identifier and mode of operation of self-equipment is broadcast periodically a period shorter than an initial processing period (S22, S23).

[0059] If it supervises whether the receive section 9 received the "server packet" (S24) and a receive section 9 receives a "server packet", the communication management section 6 will memorize a device identification child given in the packet in the other equipment information storage section 5 noting that it is a server (S25). Moreover, reception of a "device identification child packet" memorizes a "device identification child" and a "mode of operation" given in the packet in the other equipment information storage section 5 (S25).

[0060] The communication management section 6 continues periodical broadcasting of a self-device identification child packet until it is told that the initial processing period has passed since the timer section 7 (S26).

[0061] If advice is received from the timer section 7 (S26), the communication management section 6 will suspend transmission of a "device identification child packet", and refer to the other equipment information storage section 5 for it (S27).

[0062] Each actuation is explained when there is nothing to below with the case where the equipment which is operating as a server is in the equipment stored in the other equipment information storage section 5.

[0063] When a server is in the equipment stored in the other equipment information storage section 5, from the inside, one is chosen and the "subscription application packet" for applying for subscription in a communication link group is transmitted to the selected server (S33).

[0064] If a server receives a "subscription application packet", the communication management section 6 will judge the propriety of subscription of communication link GURUPUHE which self has managed as a server with reference to the communication link group information storage section 3.

[0065] If it judges that it can make it join, the communication management section 6 will transmit the "subscription authorization packet" which indicated the identifier of the communication link group who permits subscription to the equipment which transmitted the "subscription application packet", and will newly add above equipment to "the list of a communication link group's clients" memorized by the communication link group information storage section 3. Moreover, if it judges that it cannot make it join, a "subscription refusal packet" will be sent.

[0066] If a "subscription authorization packet" is sent from a server, the communication management section 6 will rewrite the mode of operation of the self-equipment memorized by the mode storage section 2 in "client mode" from a "initialization mode" (S36), and will memorize the "communication link group identification descriptor" of a publication in the communication link group information storage section 3 at a "subscription authorization packet." And it comes to operate henceforth as a client belonging to the communication link group.

[0067] If a "subscription refusal packet" is sent from a server, the communication management section 6 will choose one from the remaining server memorized by the other equipment information storage section 5 (S29), and will send a "subscription application packet."

[0068] It is repeated until this actuation is sent in a "subscription authorization packet" from one of servers.

[0069] When subscription is refused from all the servers memorized by the other equipment information storage section 5, or when there is no server into the equipment memorized by the other equipment information storage section 5, a server is newly elected.

[0070] The procedure is as follows, although a server is newly elected when subscription is refused from all the servers memorized by the equipment information storage section 5 besides <new

election of a server>, or when there is no server into the equipment memorized by the other equipment information storage section 5. When one does not have equipment memorized by the other equipment information storage section 5, it is a time of self-equipment and the equipment in the condition which can be communicated not existing. In this case, the communication management section 6 makes a "server" HE change of the mode of operation memorized by the mode storage section 2 from a "initialization mode", and operates as a server henceforth.

[0071] That is, if generate the communication link group whom self manages newly, the identifier is decided with a random number etc., a "server packet" is transmitted periodically and a "subscription application packet" is sent from the equipment of a "initialization mode", the propriety of subscription in said communication link group who generated will be judged, and a "subscription authorization packet" or a "subscription refusal packet" will be sent to the equipment according to the result.

[0072] When there is equipment memorized by the other equipment information storage section 5, the following procedure determines a self mode of operation. When each equipment of a "initialization mode" compares the identifier of the equipment of other initialization modes and the identifier of self-\*\* which are memorized by the other equipment information storage section 5, respectively, the equipment with which the value of an identifier became a server from the large thing at order (S30, S31), and did not become a server becomes a communication link group's client which said server manages (S32).

[0073] For example, when the equipment of the initialization mode of N base is memorized by the other equipment information storage section 5 and the maximum of the number of equipment per communication link group is restricted to M sets, the minimum integer I which becomes more than  $N/M$  is searched for, I high orders become a server to descending of an identifier, and the remaining equipment becomes a client.

[0074] Moreover, when there is no limit in the maximum of the number of equipment per communication link group, only equipment with the largest identifier serves as a server, and the remaining equipment becomes a client.

[0075] The case where there is no limit in the maximum of the number of communication devices per communication link group using drawing 9 about the example of the above-mentioned method is explained. The dotted line in drawing 9 (a) shows the range which a packet reaches. For example, although the packet which "equipment 1" transmitted reaches "equipment 2" and "equipment 3", it does not reach "equipment 4." Moreover, although the packet which "equipment 4" transmitted reaches "equipment 3", it does not reach "equipment 1" and "equipment 2."

[0076] Each communication device starts actuation as a "initialization mode", and broadcasts the "device identification child packet" which indicated the self device identification child and mode of operation.

[0077] Since the "device identification child packet" which "equipment 3" transmitted reaches "equipment 4", as a result of comparing the "identifier 3" of a publication, and the self "identifier 4" with the packet which received, "equipment 4" judges that a self identifier is the largest, and changes a self mode of operation into a server, and a "server packet" is henceforth broadcast instead of a "device identification child packet."

[0078] "Equipment 3" will serve as a client of the communication link group to whom delivery and "equipment 4" manage the "subscription application packet" to a communication link group to "equipment 4", if the above "a server packet" is received.

[0079] After it, "equipment 3" indicates that a self mode of operation is a "client" to a "device identification child packet", and broadcasts it to it.

[0080] Since the packet which "equipment 4" transmits does not reach "equipment 1" and "equipment 2", "equipment 1" and "equipment 2" judge that the equipment with the biggest identifier is "equipment 3."

[0081] While it is indicated by the "device identification child packet" which "equipment 3" transmits that a mode of operation is a "initialization mode", it is judged as that from which "equipment 3" turns into "equipment 1" and "equipment 2" turns into a server, and nothing is done.

[0082] "Equipment 3" serves as a communication link group's client which "equipment 4" manages, if the "device identification child packet" indicated that a self mode of operation is a "client" from

"equipment 3" is sent, "equipment 2" will judge that the equipment with the biggest identifier in the equipment of an initialization mode is self, and will change a self mode of operation into a "server", and a "server packet" will be broadcast.

[0083] communication link GURUPUHE \*\*\*\*\* which "equipment 2" will manage if "equipment 1" receives the aforementioned "server packet."

[0084] Consequently, two communication link groups as show drawing 9 (b) are constituted.

[0085] Thus, even when the equipment in which direct communication is impossible exists mutually, a server can be elected appropriately and a communication link group can be constituted.

[0086] Although the equipment which compares the size of an identifier and serves as a server is elected in the above explanation, when the identifier of equipment is being fixed, there is a problem that equipment with a large identifier tends to become a server in this method.

[0087] Since the burden is large in order to process many compared with a client, the propriety decision of subscription in the communication link group of a client of a server etc. is unfair if only specific equipment becomes a server.

[0088] However, if a random number is used as follows, a server will be decided at random and this problem will be solved.

[0089] That is, each equipment generates a "random number", and indicates and broadcasts the "random number" with the "identifier" of equipment to a "self-device identification child packet." It is made for each equipment to become order from the equipment which generated "the big random number" with a server by memorizing self the generated "random number" and "the random number received from other equipments", and comparing them mutually.

[0090] Moreover, considering that there is more processing which a server performs than a client, it is desirable to use for a server the equipment which was excellent in count capacity.

[0091] Then, the value which shows the engine performance of equipment is indicated, and each equipment compares "the self engine performance" with "the equipment engine performance given in the packet which received", and you may make it "transmission speed", "storage capacity", "calculation speed", etc. become order from the equipment which was excellent in the engine performance at a server at a "self-device identification child packet."

[0092] In this case, since the equipment which was excellent in count capacity is preferentially assigned to a server, the communication link effectiveness as the whole network improves.

[0093] In addition, if "not only a communication link group's identifier" which that server manages but the "number of clients" which has joined that communication link group is indicated to the "server packet" which a server transmits periodically and it is made to transmit to it like the 1st operation gestalt, a server can know the number of the clients belonging to the communication link group whom other servers have managed by receiving this packet. And a communication link group can be reconfigured now using this.

[0094] For example, when the servers of a communication link group with few clients negotiate, the communication link group of these plurality can be joined and it can be made a communication link group with many one clients. Moreover, the server of a communication link group with few clients can also inherit a part of client now by negotiating with the server of a communication link group with many clients.

[0095] How to divide a communication link group as follows in addition to the approach of conveying a client to other communication link groups as mentioned above, as a means to cancel a communication link group with many <dissolution technique of communication link group with many clients> clients can be considered.

[0096] The server of a communication link group with many clients divides the client belonging to the communication link group of self into the equipment group which it leaves to the communication link group of self, and the equipment group made to become independent as another communication link group.

[0097] Next, a server changes a mode of operation into a "server" from a "client" to the equipment which chose one set and was chosen out of the equipment group made to become independent as another communication link group, generates a communication link group newly, and directs to operate as the server.

[0098] Moreover, to the equipment which was not chosen as a server among the equipment groups

made to become independent as another communication link group, it directs to change a mode of operation into a "initialization mode" from a "client."

[0099] The equipment with which these directions were received and the mode of operation turned into a "initialization mode" makes a subscription application in the aforementioned communication link group created newly, and if it joins, it will resume actuation as that group's client.

[0100] Thus, division of a communication link group is performed. Moreover, although it is actuation of obtaining authorization of communication link group subscription from a server by sending a subscription application packet towards a server from the equipment of an initialization mode, with this operation gestalt, the packet which instead invites towards the equipment of an initialization mode [ a communication link group ] to make it join from a server may be sent.

[ communication link group ]

[0101] If it does in this way, the futility of processing in which the packet of invitation will be sent only to the equipment allowed subscription, send a subscription application packet, and it is refused can be excluded.

[0102] In addition, although it is guaranteed that direct communication is possible for a server and each client to mutual when the server adds the equipment of an initialization mode to the sequential communication link group as a client, generally it is not guaranteed that direct communication is possible for clients to mutual. However, in this operation gestalt, since each equipment can know the identifier of other equipments in which self and a communication link are possible by receiving a server packet or a device identification child packet, this can be used and clients can constitute mutually the communication link group to whom it was guaranteed that direct communication is possible by the approach shown below.

[0103] That direct communication is possible for <construction of communication link group in whom direct communication of clients is possible> clients to mutual performs guaranteed construction of a communication link group as follows.

[0104] The equipment of the initialization mode which wishes subscription in a communication link group indicates the list of identifiers of the equipment recognized that self and a communication link are possible to the "subscription application packet" which transmits to said communication link group's server, and is transmitted to it. A server will inspect whether the identifier of all the equipments belonging to said communication link group is contained in said list of publications to the "subscription application packet" which received, if a "subscription application packet" is received. Consequently, if all are contained, since all the equipments belonging to said communication link group and a communication link are possible for the equipment which transmitted said packet, it will permit subscription.

[0105] If the number of the equipments which are not contained in said list of publications to a "subscription application packet" in the equipment belonging to a communication link group is also one, subscription in a communication link group will be refused.

[0106] An example is shown in drawing 10 and it explains to it. The dotted line in drawing 10 (a) shows the range which a packet reaches. For example, although the packet which "equipment 1" transmitted reaches "equipment 2", "equipment 3", and "equipment 5", it does not reach "equipment 4." Moreover, although the packet which "equipment 4" transmitted reaches "equipment 5", it does not reach "equipment 1", "equipment 2", and "equipment 3."

[0107] Each equipment starts actuation as an initialization mode first, and broadcasts periodically the packet which indicated the identifier and mode of operation of self-equipment periodically as a "device identification child packet." Since the device identification child packet which "equipment 2", "equipment 3", and "equipment 5" transmitted reaches "equipment 1", "equipment 1" gets to know that "equipment 2", "equipment 3", "equipment 5", and a communication link are possible. It is the same about other equipments.

[0108] In this example, since the equipment with the largest identifier is "equipment 5", "equipment 5" serves as a server. In addition, since the election procedure of a server was already explained, it omits.

[0109] "Equipment 1", "equipment 2", "equipment 3", and "equipment 4" send the subscription application packet which applies for subscription in a communication link group to "equipment 5", respectively.

[0110] "Equipment 2", "equipment 3", and "equipment 5" are indicated as an identifier of "equipment 1" and the equipment which can be communicated by the subscription application packet which "equipment 1" transmits.

[0111] the "subscription application packet" which similarly "equipment 2" transmits as an identifier of the equipment which can communicate -- "equipment 1", "equipment 3", and "equipment 5" -- and "Equipment 5" is indicated by the "subscription application packet" which "equipment 1", "equipment 2", "equipment 5", and "equipment 4" transmit to the "subscription application packet" which "equipment 3" transmits, respectively.

[0112] Here, suppose that the "subscription application packet" which "equipment 1" transmits reached "equipment 5" early most. Since a communication link group does not have a member other than a server at this event, "equipment 5" permits subscription of "equipment 1" immediately, and adds "equipment 1" to a communication link group. Thereby, a communication link group's member serves as "equipment 1" and "equipment 5."

[0113] Then, if a "subscription application packet" arrives from "equipment 2", "equipment 5" will investigate whether all of the "identifier 1" of a communication link group's member and "an identifier 5" are indicated by the delivered "subscription application packet."

[0114] Consequently, since it turns out that it is indicated, "equipment 5" permits subscription in the communication link group of "equipment 2", and adds "equipment 2" to a communication link group.

[0115] Thereby, a communication link group's member serves as "equipment 1", "equipment 2", and "equipment 5."

[0116] Next, if a "subscription application packet" arrives from "equipment 4", "equipment 5" will investigate whether all of the "identifier 1" of a communication link group's member, "an identifier 2", and "an identifier 5" are indicated by the delivered subscription application packet.

[0117] Consequently, since it turns out that it is not indicated, "equipment 5" refuses subscription in the communication link group of "equipment 4." Furthermore, if a "subscription application packet" arrives from "equipment 3", "equipment 5" will investigate whether all of the "identifier 1" of a communication link group's member, "an identifier 2", and "an identifier 5" are indicated by the delivered "subscription application packet."

[0118] Consequently, since it turns out that it is indicated, "equipment 5" permits subscription in the communication link group of "equipment 3."

[0119] Thus, the communication link group who consists only of equipment which can communicate mutually can be constituted.

[0120] (3rd operation gestalt) By the method which elects a server as compared with mutual, information, such as an identifier of each equipment which was described in the 2nd operation gestalt, a random number, and equipment engine performance Since a server cannot be elected until it receives the aforementioned information from self-equipment and all the equipments that can be communicated, processing of election of a server, setting out of a communication link group, etc. is completed, and there is a problem of taking time amount before the communication link of applications is attained.

[0121] Without collecting the information about other equipments, each equipment can solve this because self considers as the configuration which judges independently whether it becomes a server.

[0122] Below, the operation gestalt for it is explained.

[0123] The configuration of equipment is the same as that of drawing 1 shown in the 1st operation gestalt. The probability to operate as a server is beforehand set up by a user or the equipment manufacturer, and is memorized by the communication management section 6.

[0124] The communication management section 6 is taken as a "initialization mode", when choosing whether a self mode of operation is made into a "server" according to the aforementioned probability when it is going to start a communication link and not considering as "server mode."

[0125] The communication management section 6 memorizes the result of said selection in the mode storage section 2. The equipment used as a server broadcasts the "server packet" for telling other equipments about self being a server. One is chosen from the equipment recognized that the equipment which is an initialization mode is a server by receiving a "server packet", and the

"subscription application packet" to a communication link group is sent.

[0126] If a "subscription application packet" is received, a server will judge the propriety of subscription of communication link GURUPUHE which self-\*\* manages, and will send a "subscription authorization packet" or a "subscription refusal packet" to the transmitting person of said packet.

[0127] By this method, since the equipment used as a server can be decided without communicating with equipments, time amount until a server is set up is short, and can start a communication link you to be Sumiya.

[0128] By the above-mentioned method, the probability to operate as a server is being fixed \*\* [ according to / the number of the equipment which can communicate ]. Although binomial distribution are followed at accuracy when the probability to operate as a server is set to P according to this method, and there are n equipments, the equipment of  $n \cdot P$  base extent will serve as a server about.

[0129] However, there may be no equipment with which all equipments serve as a client and serve as a server, and the probability  $P_c$  is given by  $P_c = (1-P)^n$ . Although it is desirable to enlarge Probability P in order to elect the equipment used as a server as for at least one set, if it is made such, the problem that the number of the equipment which becomes a server may increase shortly beyond the need will arise.

[0130] then, in order to solve these problems, it is possible to adopt the method which does not elect at once, but boils a server several times, divides it and elects it gradually. This method is explained below.

[0131] A flow chart is shown in drawing 11 . It explains according to drawing. First, a user is the probabilities P1 and P2 and -- which choose becoming a server as the communication management section 6. -- and Pn are set up.  $P_1 < P_2 < \dots$  -- The same value is altogether sufficient although being referred to as  $< P_n$  is desirable. Moreover, a user may not set up these values but they may be beforehand given at the time of equipment manufacture.

[0132] When choosing whether the communication management section 6 makes a self mode of operation a server according to a probability P1 when it is going to start a communication link and not making it into server mode, it considers as a "initialization mode" (S41). The communication management section 6 memorizes the result of said selection in the mode storage section 2. And Counter i is set to "0" (initialization; S42), and i is incremented (S43). And it investigates whether it chose by Probability Pi whether it could become a server (S44), and became a server about it (S45).

[0133] And when it does not become a server, a "subscription application packet" is transmitted to a server (S46).

[0134] After the 1st selection is completed, the equipment used as a server rewrites a mode of operation in "server mode" (S47). And it operates as a server. That is, the "server packet" which tells other equipments about self being a server is broadcast.

[0135] By receiving a "server packet", the equipment used as an initialization mode chooses one from the equipment recognized to be a server, and sends the "subscription application packet" to a communication link group (S46).

[0136] If a "subscription authorization packet" is sent from a server, it will join the communication link group of the server, and let a mode of operation be a client (S49).

[0137] if a fixed period passes since the 1st selection -- communication link GURUPUHE \*\*\*\*\* -- the equipment of the initialization mode which was not able to do things increments Counter i (S43). Consequently, it chooses by Probability Pi whether since i is "2", it can become a server (S44). That is, when choosing whether a self mode of operation is made into a server according to a probability P2 and not considering as a server, actuation is continued with an initialization mode. And the communication management section 6 memorizes the result of said selection in the mode storage section 2.

[0138] The equipment which became a server in this 2nd selection broadcasts a "server packet."

[0139] By receiving a "server packet", the equipment of an initialization mode chooses one from the equipment recognized to be a server, and sends the "subscription application packet" to a communication link group (S46). If a "subscription authorization packet" is sent from a server, it will join the communication link group of the server, and let a mode of operation be a client (S48,

S49).

[0140] If a fixed period passes since the 2nd selection, since the equipment of the initialization mode which was not able to join a communication link group will increment  $i$  (S43) and  $P_i = P_3$  will be obtained from  $i = 3$  obtained, according to this probability  $P_3$ , it chooses whether self serves as a server (S44). This serves as selection which is the 3rd time.

[0141] The same actuation is continued until the equipment of the initialization mode which cannot belong to a communication link group is lost.

[0142] Since it is made to increase gradually according to this method until it elects a server fewer at first and reaches sufficient number after that, although the time amount to server election is taken, it can elect a suitable number according to the number of equipment of servers.

[0143] (4th operation gestalt) By controlling the probability which serves as a server according to the number of surrounding equipment shows below the method which elects a suitable number of servers probable. The configuration of each part is the same as that of the 1st operation gestalt. It is required that the communication management section 6 of the equipment which is going to start a communication link by the charge of a power source etc. should notify that the time amount (it considers as an initial processing period) defined beforehand passes to the timer section 7.

Moreover, let the mode of operation memorized in the mode storage section 2 be an initialization mode.

[0144] Next, the communication management section 6 broadcasts the packet which indicated the mode of operation memorized by the identifier and the mode storage section 2 of the self-equipment memorized by the self-device identification information storage section 5 as a "self-device identification child packet."

[0145] Moreover, reception of the "self-device identification child packet" which other equipments transmitted memorizes the "device identification child" and the "mode of operation" which were indicated by the packet in the other equipment information storage section 5. From the timer section 7, if it is told that the initial processing period passed, the communication management section 6 will read the number of the device identification children of the initialization mode memorized by the other device identification information storage section 5 as the number of initialization-mode equipment.

[0146] The communication management section 6 computes the probability  $P$  for self to operate as a server, by the formula based on the number  $N$  of initialization-mode equipment. For example, since it is desirable for a  $N/M$  base to serve as a server among the equipment of  $N$  base when the upper limit of the number of equipment belonging to one communication link group is determined as  $M$  sets, a probability is made into  $P = M/N$ . In this case, the number of the equipment used as a server serves as binomial distribution with the highest probability used as  $M$  base.

[0147] Moreover, a response with the probability used as the number of equipment which can be communicated, and a server is calculated beforehand, it memorizes on the table, and a probability may be searched for from this table.

[0148] If it does in this way, the complicated algorithm which computation time requires for the decision of a probability can be used, the optimal value experientially calculated by experiment can be used, and a more suitable number of servers can be elected.

[0149] (5th operation gestalt) With the 5th operation gestalt, one equipment which determines which equipment should become a server is elected as mode setting equipment, and the gestalt it was made to direct whether this equipment should operate as a server to other equipments is explained. In addition, in the case of this example, the equipment to which it did not point so that it might operate as a server serves as a client.

[0150] Although a configuration is the thing of \*\*\*\* shown in drawing 1 like the 1st operation gestalt, he is trying to add the flag which shows further whether self-equipment is "mode setting equipment" in this operation gestalt to the mode of operation of the self-equipment memorized in the mode storage section 2.

[0151] In addition, the mode of operation of "mode setting equipment" is not necessarily a server. It is determined independently whether be a mode of operation and mode setting equipment.

[0152] "Mode setting equipment" is first elected at the time of communication link initiation. the election approach -- a degree -- like -- it comes out.



[0153] The communication management section 6 of the equipment which is going to start a communication link It is remembered in the mode storage section 2 that the mode of operation of self-equipment is a "initialization mode." It demands to notify, if the time amount (it considers as an initial processing period) defined beforehand passes to the timer section 7. The packet which indicated the mode of operation of the self-equipment read from the identifier and the mode storage section 2 of the self-equipment read from the self-device identification child storage section 5 is periodically broadcast as a "self-device identification child packet."

[0154] If a "self-device identification child packet" is received, the communication management section 6 will memorize a "device identification child" and a "mode of operation" given in the packet in the other equipment information storage section 5. Moreover, if the "mode setting equipment packet" which "mode setting equipment" transmits is received, a "device identification child" given in the packet will be memorized in the other equipment information storage section 5 noting that it is mode setting equipment.

[0155] The communication management section 6 will investigate the content of storage in the other equipment information storage section 5, if an initial processing period passes and advice comes from the timer section 7.

[0156] When one does not have equipment memorized by the other equipment information storage section 5, it is a time of self-equipment and the equipment in the condition which can be communicated not existing. In this case, the communication management section 6 operates as a server the mode of operation of the self-equipment memorized by the mode storage section 2 from a "initialization mode" "server mode" HE rewriting and henceforth.

[0157] Moreover, the flag memorized by the mode storage section 2 is set, and it operates also as "mode setting equipment."

[0158] "Mode setting equipment" broadcasts periodically the packet which indicated the self identifier as a "mode setting equipment packet", in order to show in other equipments that self is mode setting equipment. Furthermore, since this equipment is also a server while it is mode setting equipment, a "server packet" is broadcast periodically.

[0159] When there is equipment memorized by the other equipment information storage section 5, the following procedure determines a self mode of operation. Since "mode setting equipment" is already elected as it when the identifier of mode setting equipment is indicated by the other equipment information storage section 5 of self-equipment, election of mode setting equipment is not performed.

[0160] when "the identifier of mode setting equipment" is not indicated, the other device identification child storage section 5 memorizes -- "-- others -- identifier" of equipment is compared with "a self identifier", respectively. And when the value of a self identifier is the largest, self serves as "mode setting equipment." However, by this method, when the identifier of equipment is being fixed, equipment with a large identifier tends to turn into "mode setting equipment", and unfairness produces it.

[0161] Then, the "random number" which each equipment generated is indicated and broadcast to a packet like the election procedure of the server in the 2nd operation gestalt. Compare the size of a "random number" which received and the equipment which generated the largest random number is used as "mode setting equipment." It is good also as using the equipment which broadcast the packet which indicated the count capacity of self-equipment, compared the superiority or inferiority of the count capacity of a publication with the packet which received for every equipment, and was most excellent in count capacity as mode setting equipment etc.

[0162] Thus, if "mode setting equipment" is elected, the equipment elected as mode setting equipment will set "the flag which shows that it is mode setting equipment" formed in the mode storage section 2 of self-equipment, and will choose the equipment used as a server from the equipment of the initialization mode memorized by the other device identification child storage section 5.

[0163] For example, the equipment of the initialization mode of N base is memorized by the other device identification child storage section 5, and when it constitutes one communication link group from M equipments, "mode setting equipment" chooses N/M equipment from the equipment of the initialization mode memorized by the other device identification child storage section 5.



[0164] Although selection may be performed at random, if a N/M base is elected sequentially from what is excellent in count capacity since the count capacity of each equipment is known beforehand when an identifier or not a random number but the count capacity of each equipment elect mode setting equipment, the equipment which was excellent in count capacity can be made into a server.

[0165] "Mode setting equipment" and the equipment which became will send the "server mode directions packet" for directing to operate as a server to the selected equipment, if the equipment made into a server is chosen.

[0166] If a "server mode directions packet" is received, the communication management section 6 will rewrite the self mode of operation memorized by the mode storage section 2 in "server mode" from a "initialization mode", and will start the actuation as a server.

[0167] That is, the communication link group whom self manages is newly generated, and the "server packet" which shows that it is a server is broadcast.

[0168] If it judges that self-equipment was not chosen as a server, reception of a "server packet" is continued and a fixed period passes, the equipment of the initialization mode which received the "server packet" will choose one from the identifier of the server stored in the other device identification child storage section 5, and will send the "subscription application packet" which applies for subscription in a communication link group to the server.

[0169] If a "subscription application packet" is received, a server will judge the propriety of adding the equipment which transmitted the packet to the communication link group whom self manages, and will send a "subscription authorization packet" or a "subscription refusal packet" according to the result.

[0170] The equipment which received the "subscription authorization packet" rewrites a mode of operation in "client mode" from a "initialization mode", and it operates henceforth as a client.

[0171] A "subscription refusal packet" is sent from all servers, a communication link group can be joined and inside \*\*\*\* equipment sends the "server election demand packet" which requires election of a new server to "mode setting equipment."

[0172] If a "server election demand packet" is received, a mode of operation will choose the equipment operated as a server from the equipment which is "initialization modes", and will take [ operating as a server to the equipment, and ] out directions with "mode setting equipment."

[0173] Thereby, all equipments start actuation as a "initialization mode." And when "mode setting equipment" does not exist, equipment with the largest identifier turns into mode setting equipment. Suppose that equipment with the now largest identifier was "equipment 6." Then, "equipment 6" turns into mode setting equipment in this case.

[0174] And "mode setting equipment" and this the "equipment 6" that became choose at random the equipment which should operate as a server, and issues [ operating as a server, and ] directions.

[0175] Here, suppose that "equipment 2" and "equipment 3" were chosen as a server. The actuation after server selection is the same as that of the 1st operation gestalt etc.

[0176] That is, it joins the communication link group whom "a server 2" or "a server 3" manages, respectively by transmitting the "subscription application packet" to a communication link group to "equipment 1", "a server 2", or "a server 3", respectively.

[0177] Although "equipment 6" is mode setting equipment, after choosing the equipment used as a server, it operates as a communication link group's client which "a server 3" manages.

[0178] (6th operation gestalt) After it, once a server is elected in the operation gestalt explained until now, when the equipment which starts a communication link by switching on a power source etc. is after the election procedure of a server was completed in order not to perform election actuation of a server, the number of servers runs short and the equipment put into no communication link group may come out.

[0179] In order to solve this, it puts into a communication link group and a server is newly elected from inside \*\*\*\* equipment. The equipment which was not put into the communication link group makes a mode of operation a "initialization mode." In addition, since the mode of operation of equipment which has joined the communication link group is "server mode" or "client mode", it is whether a mode of operation is an initialization mode, and can identify whether communication link GURUPUHE subscription is carried out.

[0180] In the server election procedure of the equipments which were not able to join a

communication link group, with reference to the mode storage section 2, if a mode of operation is not a "initialization mode", since the communication management section 6 of each equipment has already joined the group, nothing will carry out it.

[0181] The equipment which the equipment which is an initialization mode elected the equipment which serves as a server out of the equipment of an initialization mode with the same procedure as the 2nd [ which was explained until now ] and 3rd operation gestalt, and did not become a server serves as a communication link group's client which the elected server created newly.

[0182] (7th operation gestalt) The communication link of the equipments belonging to a different communication link group is performed by the server of the communication link group to whom each equipment belongs relaying a packet. For this reason, when the communication link of a server becomes impossible by cutting of a power source etc., the communication link with the equipment belonging to other communication link groups becomes impossible. Moreover, since it is a server, managing a communication link group's client and judging the propriety of subscription in a group will also produce the problem that a new client cannot be added to the communication link group, if a server is not.

[0183] Then, it is necessary to detect that the server stopped being from a communication link group, and to elect an alternative server. This approach is described below.

[0184] As explained in the 1st, 2nd, and 3rd operation gestalt, the server has broadcast periodically the "server packet" which indicated the self identifier and a communication link group's identifier which self manages, in order to show in other equipments that self-\*\* is operating as a server.

[0185] It judges that the communication link of a server became impossible if it supervised whether the server of the communication link group to which, as for a client, self-\*\* belongs on the other hand to a "server packet" would be sent periodically and sent beyond a fixed period, the mode of operation of self-\*\* is rewritten to an initialization mode, and the same procedure as the operation gestalt of the 2nd and \*\* a 3rd reelects a new server.

[0186] When it judged that a server cannot add a new client to the communication link group whom self manages and recruiting of a client was stopped, it was made to suspend transmission of a server packet in the 1st operation gestalt.

[0187] However, if transmission of a server packet is suspended in this operation gestalt, the inconvenience that a client will consider that the communication link of a server became impossible will arise. Then, irrespective of whether a client is under recruiting, in order to attach distinction with the termination of the client recruiting by the server, and the communication link of a server having become impossible, "the flag which shows whether a client is under recruiting" is newly formed in a "server packet", and a server transmits a "server packet" periodically.

[0188] A server sets the aforementioned "flag", when a new client can be added to the communication link group whom self manages, and when a new client cannot be added, it clears a "flag."

[0189] The equipment whose mode of operation is a "initialization mode" applies for subscription in the SABAHE communication link group who transmitted the packet, only when the "server packet" from which the aforementioned "flag" serves as ON is received.

[0190] If it does in this way, since a server will surely transmit a "server packet" periodically, a client can judge a server to be \*\*\*\*\* impossible [ a communication link ], if a "server packet" is not sent beyond a fixed period.

[0191] For the procedure explained above, when the communication link of two or more servers becomes impossible simultaneously All two or more communication link groups' equipments that two or more aforementioned servers had managed, respectively change a mode of operation into an initialization mode. Since a server is rechosen regardless of the communication link group of a basis and a communication link group is reconstituted out of all the equipment of them, the reconstituted group has the problem of becoming a different thing from the communication link group of a basis.

[0192] In order to avoid this, to the "device identification child packet" which the equipment of an initialization mode transmits If in addition to "the identifier of self-equipment", and a "mode of operation" "a communication link group's identifier to which self-equipment belonged before the communication link of a server became impossible" is indicated and a "device identification child packet" is received What is necessary is to inspect the "communication link group identification

descriptor" of a publication to the packet, to ignore and just to make it discard, when it is a different thing from the communication link group to whom self-equipment belonged.

[0193] If it does in this way, a communication link group can be reconfigured by the member same before the communication link of a server becomes impossible. Moreover, a client can transmit the packet which shows existence of self periodically to the server of the communication link group to whom self belongs, and it can detect whether the aforementioned packet is sent periodically and that the communication link of a client became impossible when making it supervise from a communication link group's client which self manages [ a server ].

[0194] A server notifies that the communication link of said equipment became impossible also to other communication link groups' server at the same time it will notify the identifier of the equipment whose communication link became impossible by the multicast to the communication link group's member, if it detects that the communication link of a communication link group's client which self manages became impossible.

[0195] (8th operation gestalt) In subscription of the equipment to a communication link group, since a group, then communicative effectiveness improve in a group with the same equipment with the high frequency of a mutual communication link, it is desirable. For example, it sets to the joint activity of the teleconference by communication link mutual [ between two or more equipments ] etc. When "the equipment 1", "the equipment 2" and "the equipment 3" which participate in the first board, and "the equipment 4", "the equipment 5" and "the equipment 6" which participate in the second board exist The first communication link group is created with "equipment 1", "equipment 2", and "equipment 3", and the second communication link group is created with "equipment 4", "equipment 5", and "equipment 6", respectively.

[0196] Taking the case of such a case, it explains below. First, the equipment which serves as a server in each communication link group is determined. Each equipment makes a mode of operation a "initialization mode", and broadcasts the packet which indicated "the information on whether the board where self participates is the first board, or it is the second board" with "the identifier of self-equipment" as a "device identification child packet."

[0197] receiving a "device identification child packet" -- "-- others -- since "a board where the equipment participates" turns out to be identifier" of equipment, the communication management section 6 memorizes this in the other equipment information storage section 5.

[0198] Next, the communication management section 6 of each equipment classifies the device identification child stored in the other device identification child storage section 5 for every board where the equipment participates, and makes a server equipment with the largest identifier in the equipment which participates in the same board.

[0199] In selection of the server out of the equipment which participates in the same board, the random number which the identifier of equipment was used in this way, and also equipment generated like the 2nd operation gestalt, and the count capacity of equipment may be used.

[0200] One set of a server is elected by the above-mentioned procedure for every equipment which participates in the same board, respectively. The equipment used as a server indicates "a communication link group's identifier", and "the information on whether the classification of a board is the first board, or it is the second board" to the "server packet" which shows that self is a server, and broadcasts them periodically to it.

[0201] The equipment used as a server sends a "subscription application packet" to the server which participates in the same board as self. A server will indicate and return "the identifier of the communication link group corresponding to the board where self participates" to the "subscription authorization packet" which shows the authorization to subscription in a communication link group, if a "subscription application packet" is received.

[0202] The equipment which received the "subscription authorization packet" memorizes a "communication link group identification descriptor" given in a packet in the communication link group information storage section 3, and it is made to make it operate henceforth as the communication link group's client.

[0203] In addition, you may make it how to divide a communication link group belong to the same communication link group with the equipments which use the information not only about a board but affiliation of a user as mentioned above, and the user who works at his same post uses.

[0204] Moreover, a communication link group may be divided for every application currently performed in equipment. For example, when there is application of the application game of a teleconference and the user is performing any one among these, the equipment which, as for the equipment which is performing application of a teleconference, is performing application of a game to "the communication link group 1" is the condition which said that "the communication link group 2" was made to join, respectively.

[0205] Since it is thought that the frequency of a communication link of the equipments which are performing the same application is higher than the frequency of the communication link with the equipment which is performing different application, communicative increase in efficiency can be attained by dividing a communication link group in this way.

[0206] (9th operation gestalt) In old explanation, although the random number was used for a communication link group's identifier, in order to avoid the accidental coincidence of the random number which two or more servers generated, it is necessary to make [ many ] the digit count of a random number. Since it is used as the address for a communication link, when a digit count increases, "a communication link group's identifier" requires time amount for "processing of filtering" which judges the address of the destination address of a packet and self by whether it compares and is in agreement at the time of reception of a packet, and its effectiveness is bad. [ be / it / a packet addressed to self ]

[0207] Then, the effectiveness of reception is raised by setting up the "communication link group identification descriptor" of a small digit count by bargaining of servers, and making it use as the address.

[0208] Like the 1st operation gestalt, although the configuration of this operation gestalt is a configuration of \*\*\*\* shown in drawing 1, in addition to "the identifier of the communication link group to whom self-equipment belongs", it memorizes "the list of a communication link group's identifiers with which self-equipment does not belong" as an "other communication link group identification descriptor list" in the communication link group information storage section 3.

[0209] A procedure until it generates a communication link group and sets up the address is shown below. First, a server is elected.

[0210] Election of a server may choose whether each equipment serves as a server probable, without each equipment's generating a random number, and transmitting the packet which indicated the random number, electing by comparing the received random number mutually like the 2nd operation gestalt, and being based on the communication link between equipment like the 3rd operation gestalt.

[0211] Election of a server sets [ next ] up a communication link group identification descriptor. The flow chart of this configuration procedure is shown in drawing 12 - drawing 14. Drawing 12 is general drawing and drawing 13 and drawing 14 are the elements on larger scale. The communication management section 6 of each server chooses from the integers from "1" to "256" at random one numeric value used as a "communication link group identification descriptor", and memorizes it in the communication link group information storage section 3 (S71).

[0212] Next, after a server demands the timer section 7 to notify that fixed period (it considers as communication link group identification descriptor setting-out period) progress is carried out (S72), it hits the packet which indicated the selected numeric value to other servers as a "communication link group identification descriptor packet", and broadcasts it periodically in it a period shorter than a communication link group identification descriptor setting-out period (S73).

[0213] Equipments other than a server are disregarded even if a "communication link group identification descriptor packet" arrives. A server compares a numeric value given in the packet with "the communication link group identification descriptor of self" memorized in the communication link group information storage section 3, if a "communication link group identification descriptor packet" is received (S74) (S75, S76). And if not the same as a result of a comparison, the numeric value will be added to an "other communication link group identification descriptor list" (S77).

[0214] On the other hand, as a result of a comparison, when the same, it is duplication of a "communication link group identification descriptor." Therefore, it demands anew to notify, if only a communication link group identification descriptor setting-out period passes in this case since the event of the communication management section 6 resetting the timer section 7, and detecting

duplication of an identifier in the timer section 7.

[0215] Furthermore, in order to tell other servers about duplication of a "communication link group identification descriptor", others carry out the Sir BAHEBU load cast of the "communication identifier collision packet" which indicated said communication link group identification descriptor which collided (S78). In addition, the transmitting person of a "communication identifier collision packet" does not change a communication link group identification descriptor.

[0216] The communication management section 6 of equipment which received the "communication identifier collision packet" resets up the timer section 7 like the server which detected the collision of a "communication link group identification descriptor", and compares the "communication link group identification descriptor" of a publication, and the "communication link group identification descriptor" of self with the packet (S81). Consequently, if the same, the "communication link group identification descriptor packet" which indicated the numeric value which chose the "communication link group identification descriptor" as one random (S84), and newly chose it from what is not indicated by the "other communication link group identification descriptor list" for the integers from "1" to "256" will be broadcast periodically (S73).

[0217] All identifiers are indicated from "1" to "256", and when there is no vacant identifier, or when a collision is detected also about the rechosen communication link group identification descriptor by the "other communication link group identification descriptor list", the communication management section 6 changes into it the self mode of operation which memorized the actuation as a server in a stop and the mode storage section 2 from "server mode" at a "initialization mode" (S83).

[0218] Since it turns out that the collision of a communication link group identification descriptor was not detected during the period when advice of the communication link group identification descriptor setting-out period having passed is received from the timer section 7 (S79), a "communication link group identification descriptor" is memorized in the communication link group information storage section 3, and the procedure of group identification descriptor setting out is ended (S80).

[0219] If a "communication link group identification descriptor" is set up by the above-mentioned procedure, recruiting of the client by the server will be performed next. A server gives an integral identifier to the client belonging to the communication link group whom self manages according to the sequence of subscription.

[0220] For example, the identifier of a server sets to "1" and sets to "3" the identifier of the client which joined "2" and eye NI watch in the identifier of the client which joined first.

[0221] The descriptive procedure of the identifier of this client is explained below. A sequence is shown in drawing 15. Counter i is formed in the communication management section 6. Using this counter i, in order that a server may publish an identifier to a client, initial value is "2."

[0222] [Processing 1] To the "server packet" which shows that self is a server, the equipment used as a server indicates and broadcasts self "a communication link group's identifier G" and the aforementioned "value i of a counter" to manage.

[0223] [Processing 2] The communication management section 6 of the equipment of the initialization mode which received the "server packet" memorizes the "counter value i" of a publication, and "communication link group identification descriptor G" to a "server packet." Furthermore, the packet which generated "the random number R" and indicated the above "counter value i" and the random number R described above "generated" to be "communication link group identification descriptor G" of a publication to the "server packet" which received is broadcast as a "communication link group subscription application packet."

[0224] The communication management section 6 also memorizes said generated random number.

[0225] [Processing 3] The communication management section 6 of a server will inspect whether a "communication link group identification descriptor" given in the packet is the same as the "communication link group identification descriptor" of self, and the "counter value" of a publication is the same as self "value of a counter" to a packet, if a "communication link group subscription application packet" is received. Consequently, if both are the same, they will memorize the "random number" indicated by the "communication link group subscription application packet", and will broadcast the "communication link group subscription authorization packet" which

indicated the "communication link group identification descriptor" of self-\*\* to be this "random number."

[0226] [Processing 4] The communication management section 6 of equipment which received the "communication link group subscription authorization packet" If both are in agreement with a packet as compared with the "random number R" of a publication, the "random number R" which memorized "communication link group identification descriptor G" in "[processing 2]", and "communication link group identification descriptor G" It judges that subscription of GURUPUHE was permitted and let the memorized "counter value" be the "device identification child" of self. Furthermore, the packet which indicated the "communication link group identification descriptor", the "random number R", and the "counter value i" is broadcast as a "subscription check packet."

[0227] [Processing 5] When a "subscription check packet" is received, a server to a packet "communication link group identification descriptor G" of a publication, and "a random number R" self -- "-- a communication link -- a group identification descriptor -- G -- " -- and -- " -- [-- processing -- three --] -- " -- setting -- having memorized -- "-- a communication link -- a group -- subscription -- an application -- a packet -- " -- a publication -- "-- a random number -- R -- " -- comparing -- both -- \*\*\*\* -- being in agreement -- if -- A "communication link group subscription authorization packet" judges it as what surely reached the partner, increases the one "value i of a counter", and returns to "[processing 1]."

[0228] It repeats until it reaches the upper limit (for example, 256) as which the client which wishes subscription in a communication link group stops having been, and the value of a counter determined the above-mentioned processing beforehand.

[0229] Thus, if a "communication link group identification descriptor" and a "device identification child" are set up, since each equipment will be identified by the meaning in the group of a "communication link group identification descriptor" and a "device identification child", it can communicate mutually by using this group as the address.

[0230] The whole of this address selection procedure is performed by broadcasting, and specification of the equipment in transmission and reception of a packet Although it is not necessary to assign the identifier of a proper beforehand to equipment since it is based on the random number which the equipment generated When the identifier of a proper is beforehand given by the equipment manufacturer or the user at equipment, or when the serial number of a proper etc. is given to the application used in equipment, you may make it use these values instead of the aforementioned random number.

[0231] Since a communication link group's total is restricted to "256 pieces" and the number of the equipment which can join one communication link group is restricted to "256 sets", although the number of the equipment which can communicate will be simultaneously restricted to "65536 sets", "8 bits" is sufficient for distinguishing communication link "256 groups" with the above-mentioned example.

[0232] Since all equipments can be mutually distinguished by total of the 16-bit address since 8 bits is sufficient similarly about distinction of each 256 equipments, and it can do [ rather than ] short as the address using the identifier of a random number or an equipment proper, filtering at the time of packet reception can be performed promptly, and an efficient communication link is attained.

[0233] (10th operation gestalt) Although the server assigned the device identification child in order to the client, you may make it also set up assignment of the device identification child of a client in the 9th operation gestalt by bargaining of equipments as well as the decision of the group identification descriptor of a server.

[0234] In this case, although a server sets up a communication link group's identifier which self manages, makes the equipment of an initialization mode a client and being added to the aforementioned communication link group, grant of the identifier to the equipment used as a client is not performed.

[0235] The setting-out approach of the communication link group identification descriptor by the server is the same as that of the 9th operation gestalt.

[0236] If a communication link group's identifier is set up, a server will add a client to the communication link group whom self manages in the following procedures. A server broadcasts the packet which indicated a communication link group's identifier which self manages as a server

packet.

[0237] The equipment of the initialization mode which received the server packet generates a random number, and the packet which indicated the "group identification descriptor" of a publication and the aforementioned "random number" to the server packet is transmitted as a "group subscription application packet."

[0238] The communication management section 6 memorizes the aforementioned "group identification descriptor" and the generated "random number." The server which received the "group subscription application packet" compares with the packet the "communication link group identification descriptor" of a publication, and the "communication link group identification descriptor" which self manages, and if the same, it will send the packet which indicated the aforementioned "communication link group identification descriptor" and the aforementioned "random number" as a "communication link group subscription authorization packet."

[0239] The communication management section 6 of equipment which received the "communication link group subscription authorization packet" compares with the "communication link group identification descriptor" of a publication, the "group identification descriptor" which memorized the "random number", and a "random number" at a packet. Consequently, if the same, it judges that it is "subscription authorization to self-\*\*", and the aforementioned "group identification descriptor" will be memorized in the communication link group information storage section 3, and it will operate henceforth as the group's client in it.

[0240] Thus, if the communication link group to whom all equipments belong is decided, the "device identification child" of a meaning will be set up within the communication link group with all the equipments that include the server belonging to the same communication link group with the same procedure as servers set up the "communication link group identification descriptor" in the 9th operation gestalt.

[0241] The "address" also including the equipment belonging to other communication link groups which serves as a meaning among all equipments can be obtained by combining a communication link group's "identifier" to which equipment belongs, and said "device identification child" who set up.

[0242] In addition, although the random number which the equipment generated is used for discernment of the equipment to which it applies for subscription in a communication link group in the above-mentioned explanation, when the identifier of a proper is beforehand set up for every equipments, such as a serial number of equipment, the identifier may be used instead of a random number. However, even if it is the case where there is an identifier of the equipment proper set up beforehand, the device identification child set up by the procedure explained here is used for the address in a communication link.

[0243] This is because the address can be shortened and it contributes to communicative increase in efficiency, as explained in the 9th operation gestalt.

[0244] According to this method, since "setting out of the "communication link group identification descriptor" of servers" and "setting out of the "device identification child" of equipments belonging to the same group" are performed by the same procedure, when software realizes this method, setting out of said NI \*\* can be performed using a common program, the part and the number of program steps can be lessened, and a design becomes easy, for example.

[0245] (11th operation gestalt) When many communication link groups exist, improvement in effectiveness of a communication link can be aimed at by dividing them into some high order groups, and managing them. Next, the example is explained.

[0246] an enterprise -- setting -- " -- " -- a marketing department -- " -- " -- one -- a section -- " -- " -- two -- a section -- " -- " -- " -- " -- the Administrative Division -- " -- " -- one -- a section -- " -- " -- two -- a section -- " -- " -- each -- a section -- belonging -- a user -- a communication link -- carrying out -- \*\* -- carrying out .

[0247] At this time, a communication link group is generated with the equipments of the user who belongs to the same section first, respectively. For example, they are a "one operating communication link group", a "two operating communication link group", etc.

[0248] Next, the group of a high order is generated to the pan which consists of two or more communication link groups belonging to the same section. For example, "the one operating



communication link group belonging to a marketing department" and "the marketing department group who consists of two operating communication link groups" are generated. It is because it is thought that there is more traffic of the equipments belonging to the same section than the traffic of the equipments belonging to the different section.

[0249] Thus, by preparing the group of a high order, and dividing and managing a communication link group, a communication link group with much traffic between groups can be summarized, and interference to other communication link groups can be lessened.

[0250] For example, a wireless electric wave is used for the transmission and reception in a network, and when the frequency band is selectable out of plurality, if the first frequency band is assigned to the equipment belonging to a marketing department group and the second frequency band is assigned to the Administrative Division group, interference by the communication link between the equipment belonging to other high order groups can be prevented.

[0251] In this case, the procedure until it generates a communication link group and prepares a server and a client for every communication link group is the same as that of the operation gestalt explained until now.

[0252] After the election procedure of a server and a client finishes, bargaining of servers generates the group of the high order which makes only a communication link group's server a member. Each the server and client in a high order group are elected only from a communication link group's server, and a communication link group's client of the election procedure of a high order group's server and a client is completely the same as that of it in a communication link group, if the point of not participating in a high order group's generation procedure at all is removed.

[0253] In addition, if the number of communication link groups increases, two or more high order groups will be prepared. If the number of high order groups increases with the increment in communication link group number, it will be the servers of the high order group of these plurality, and the group of a high order will be created further.

[0254] Thus, if the group of a high order is created more according to the increment in the number of groups, even when many equipments exist, it can manage efficiently. An example is shown in drawing 16. "The equipment 3" which is the server of "the communication link group 1", and "the equipment 4" which is the server of "the communication link group 2" constitute "the high order group 1", and "the equipment 12" which is the server of "equipment 9", and "the communication link group 5" which is a server of "equipment 8" and the "communication link group 4" which is a server "the communication link group 3" constitutes "the high order group 2" from this example

[0255] Into "the high order group 1", "equipment 4" serves as a server and "equipment 3" serves as a client.

[0256] Moreover, into "the high order group 2", a server, "equipment 9", and "equipment 12" serve as [ "equipment 8" ] a client. That is, while "equipment 4" and "equipment 8" are a communication link group's servers, they are also a high order group's server, and while "equipment 3", "equipment 9", and "equipment 12" are a communication link group's servers, they are also a high order group's client.

[0257]

[Effect of the Invention] In the communication system with which this invention consists of two or more communication devices, and at least one employs a server and others as a client as explained above Since it enabled it to constitute a communication link group when a server was elected from two or more communication devices, and the elected server generated a communication link group and added to a communication link group by making said two or more of other equipments into a client Autonomous network administration by transmission and reception of the beacon shown in Japanese Patent Application No. No. 87937 [ 07 to ] can be performed now per said communication link group, and the communication system which can cope with the increment in the number of equipment flexibly is obtained.

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[Translation done.]